AMENDMENTS TO THE CLAIMS

The following Listing of Claims, with prior withdrawal of claims 1-6, 10-15 and 19-22, and amendments to claims 7-9 and 16 will replace all prior versions, and listings, of claims in the application. ***No new matter is introduced as a result of the following claim amendments.***

Listing of Claims:

1 (Withdrawn). A system for computing a network code, comprising:

computing flows between at least one sender and two or more receivers; and

computing network code coefficients restricted to the computed flows.

2 (Withdrawn). The system of claim 1 wherein the network code coefficients include:

encoding vectors for each interior network node, including a sender; and

decoding matrices for each receiver.

3 (Withdrawn). The system of claim 2 wherein the elements of the encoding vectors and decoding matrices are elements of a finite field whose size does not depend on the rate of the computed flows.

4 (Withdrawn). A system for transmitting symbols from at least one sender to two or more receivers via a plurality of interior network nodes, comprising:

restricting the symbols to flows between the at least one sender and the two or more receivers;

encoding at each interior network node the symbols entering the node into symbols exiting the node; and

decoding at each receiver the symbols entering the receiver.

5 (Withdrawn). The system of claim 4 wherein the encoding and decoding are linear operations.

6 (Withdrawn). The system of claim 5 wherein the linear operations are over a finite field whose size is independent of the rate of the computed flows.

7 (Currently Amended). A system for computing a network code, comprising:

a network having a sender node, one or more interior nodes, and one or more receiver nodes, each node having one or more edges connecting to one or more interior nodes in the network;

means for computing a set of linear combination coefficients for each edge entering each node, each set of linear combination coefficients representing an encoding vector for each edge for encoding symbols transmitted along each corresponding edge; ~~of at least one interior network node of a network, said nodes including a sender;~~

wherein each symbol provides a symbolic representation of one or more encoded bits of data, and wherein each symbol belongs to a finite library of symbols;

means for computing ~~representation vectors~~ a decoding vector for ~~symbols~~ each edge exiting each interior network node from ~~representation vectors for symbols entering each node and~~ the linear combination coefficients of the edges entering each node, wherein each decoding vector is used for decoding symbols transmitted along each corresponding edge; ~~and~~

means for computing decoding matrices for each ~~of at least one~~ receiver node of the network from the ~~representation~~ decoding vectors ~~for the symbols entering each receiver~~; and

means for constructing a network code for at least a portion of the network, including the sender node, each interior node, and one or more of the receiver nodes, from the corresponding linear combination coefficients, the ~~representation~~ corresponding decoding vectors and the corresponding decoding matrices.

8 (Currently Amended). The system of claim 7 further comprising means for allowing each receiver node to use a corresponding one of the decoding matrices to decode data transmitted from ~~setting encoding vectors for each interior node, including~~ the sender node, to the receiver node across a plurality of edges of the network between the sender node and the receiver node ~~linear combination coefficients~~.

9 (Currently Amended). The system of claim 7 wherein computing the linear combination coefficients further includes means for ensuring that the ~~representation~~ encoding vectors for the symbols transmitted across edges on a cut between the sender and each receiver are full rank, such that the rank of each encoding vector is the same as the smallest dimension of that vector.

10 (Withdrawn). A computer-implemented process for computing efficient network codes for a multicast network, comprising using a computing device to:

receive known parameters defining a multicast network, which includes a plurality of internal network nodes, including at least one sender, and two or more receivers;

compute flows between the sender and the two or more receivers using the known parameters; and

compute encoding vectors for each internal network node, including the at least one sender, wherein encoding vector coefficients are restricted to the computed flows; and

compute decoding matrices for each receiver.

11 (Withdrawn). The computer-implemented process of claim 10 wherein computing efficient network codes for a multicast network includes an initialization stage comprising:

reducing the multicast network to a network with edges between internal nodes having unit capacities by replacing each edge having a capacity c with c edges having unit capacity.

12 (Withdrawn). The computer-implemented process of claim 11, wherein the initialization stage further comprises:

a determination of whether each edge having unit capacity is within the computed flows; and

ordering any edges within the computed flows topologically from the sender to the two or more receivers.

13 (Withdrawn). The computer-implemented process of claim 12 wherein the topologically ordered edges are used for computing the encoding vectors.

14 (Withdrawn). The computer-implemented process of claim 12 wherein the topologically ordered edges are used for computing the decoding matrices for each receiver.

15 (Withdrawn). The computer-implemented process of claim 10 wherein the network parameters include:

a network layout;

a flow capacity of each internal node in the network, including flow capacities of the at least one sender and the two or more receivers.

16 (Currently Amended). A computer-implemented process, including computer executable instructions stored on a physical computer-readable medium, for computing a network code for a network including at least one sender, a plurality of internal nodes and at least one receiver, comprising using a computing device to:

compute a set of one or more linear combination coefficients for each interior network node and the at least one sender, wherein each set of linear combination coefficients represents a corresponding encoding vector for encoding symbols exiting a corresponding one of the sender and the internal nodes;

compute ~~representation~~ decoding vectors for symbols exiting each interior network node from ~~representation vectors for symbols entering~~ the linear combination coefficients corresponding to each interior network node ~~and the computed linear combination coefficients~~; ~~and~~

compute decoding matrices for each receiver from the decoding vectors of all internal nodes of the network;~~the representation vectors for the symbols entering each receiver.~~ and

construct a network code from the linear combination coefficients, the decoding vectors and the decoding matrices.

17 (Currently Amended). The computer-implemented process of claim 16 further comprising allowing each receiver to use a corresponding one of the decoding matrices to decode data transmitted across a path through one or more of the interior nodes between the at least one

sender and the at least one receiver ~~designating the linear combination coefficients as encoding vectors for each interior node and the at least one sender~~.

18 (Currently Amended). The computer-implemented process of claim 16 wherein computing the linear combination coefficients further includes ensuring that the ~~representation~~ encoding vectors for symbols transmitted across edges on a cut between the at least one sender and each receiver are full rank, such that the rank of each encoding vector is the same as the smallest dimension of that vector.

19 (Withdrawn). A method for constructing multicast network codes, comprising:

inputting a network layout defined by:

two or more receivers,

a plurality of internal network nodes with at least one edge between each node, said nodes including a sender, and

a flow capacity of each edge;

computing flows from the network layout between the sender and the two or more receivers;

computing network codes for each internal network node, including the sender, from the computed flows, said network codes comprising encoding vectors for encoding one or more symbols for multicast transmission from the sender through the network to the two or more receivers; and

computing decoding matrices for each receiver for decoding each encoded symbol multicast to each receiver.

20 (Withdrawn). The method of claim 19 wherein computing flows from the network layout between the sender and the two or more receivers includes an initialization stage comprising:

reducing the network layout by replacing each edge having a capacity c with c edges having unit capacity; and

determining whether each edge having unit capacity is within the computed flows.

21 (Withdrawn). The method of claim 20 wherein the initialization stage further comprises ordering any edges determined to be within the computed flows topologically from the sender to the two or more receivers.

22 (Withdrawn). The method of claim 21 wherein the topologically ordered edges are used for computing the decoding matrices for each receiver for decoding each encoded symbol multicast to each receiver.